

5    **WHAT IS CLAIMED IS:**

1.    An anode forming part of a solid state electrochemical device, said anode bonded to a dense electrolyte layer and comprising a porous three-dimensional solid phase comprising:

- (a)    an electrocatalytic noble metal phase comprising a plurality of noble metal particles;
- (b)    an ionic conducting phase comprising a plurality of ionic conductor particles;

wherein said noble metal phase and ionic conducting phase are interspersed and wherein the mean size of said noble metal particles is substantially equal to or larger than the mean size of said ionic conducting particles.

2.    The anode of claim 1 wherein the solid phase of the anode is comprised of about 1% to about 95% noble metal phase by volume.

3.    The anode of claim 2 wherein the solid phase of the anode is comprised of about 1% to about 50% noble metal phase by volume.

4.    The anode of claim 3 wherein the solid phase of the anode is comprised of about 5% noble metal phase by volume.

5.    The anode of claim 3 wherein the solid phase of the anode is comprised of about 30% noble metal phase by volume.

6.    The anode of claim 3 wherein the solid phase of the anode is comprised of about 50% noble metal phase by volume.

- 5 7. The anode of claim 1 wherein the mean size of said noble metal particles is at  
least about twice as large as the mean size of the ionic conductor particles.
8. The anode of claim 7 wherein the mean size of said noble metal particles is at  
least about four times as large as the mean size of the ionic conductor particles.
- 10 9. The anode of claim 1 wherein the anode forms part of an electrolyte or cathode  
supported solid oxide fuel cell.
10. The anode of claim 9 wherein the anode is less than about 10  $\mu\text{m}$  thick.
- 15 11. The anode of claim 1 wherein the noble metal comprises palladium.
12. The anode of claim 1 wherein the ion conductor particles are comprised of YSZ.
- 20 13. A solid state electrochemical device comprising a cathode, a dense electrolyte and  
an anode comprising a porous three-dimensional structure comprising linked  
particles of an noble metal material and linked particles of an ionic conductor  
wherein the mean or median size of the noble metal particles is larger than the  
mean or median size of the ion conducting particles.
- 25 14. The solid state electrochemical device of claim 13 wherein the device is a solid  
oxide fuel cell.
15. The fuel cell of claim 14 wherein the noble metal comprises palladium.
- 30 16. The fuel cell of claim 14 wherein the mean or median noble metal particle size is  
at least about 2 times larger than the mean or median ion conductor particle size.

- 5 17. The fuel cell of claim 16 wherein the mean or median noble metal particle size is about 4 to about 10 times larger than the mean or median ion conductor particle size.
- 10 18. The fuel cell of claim 14 wherein the ionic conductor is comprised of the same ion conducting material as the electrolyte layer.
19. The fuel cell of claim 18 wherein the electrolyte and ion conducting particles are both comprised of YSZ.
- 15 20. The fuel cell of claim 14 wherein the anode is less than about 10 $\mu$ m thick.
21. A method of forming an anode for use in a solid state electrochemical device having a dense electrolyte layer comprising the steps of:
  - 20 (a) mixing noble metal particles with ion conducting particles where mean or median size of the noble metal particles is substantially equal to or larger than the mean or median size of the ion conducting particles; and
  - (b) creating a porous three-dimensional structure bonded to the dense electrolyte layer, said structure comprising linked particles of the noble metal particles and linked particles of the ionic conductor.
- 25 22. The method of claim 21 wherein the noble metal particles, the ion conducting particles , a suitable organic binder and a suitable solvent are mixed in appropriate volumes to form a paste which is then screen printed onto the dense electrolyte.
- 30 23. The method of claim 22 wherein the noble metal particles comprise palladium.
24. The method of claim 22 wherein the ion conducting particles are comprised of YSZ.

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